

**U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Melicope hiiakae*

COMMON NAME: Alani

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: August 2005

STATUS/ACTION

☐ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: May 11, 2004

☐ 90-day positive - FR date:

☒ 12-month warranted but precluded - FR date: May 11, 2005

☐ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (<http://endangered.fws.gov>).

☐ Listing priority change

Former LP: ☐

New LP: ☐

Date when the species first became a Candidate (as currently defined): 1997

☐ Candidate removal: Former LP: ☐

☐ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

- ___ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- ___ F – Range is no longer a U.S. territory.
- ___ I – Insufficient information exists on biological vulnerability and threats to support listing.
- ___ M – Taxon mistakenly included in past notice of review.
- ___ N – Taxon does not meet the Act’s definition of “species.”
- ___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Rutaceae (Rue family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Oahu

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Oahu

LAND OWNERSHIP: *Melicope hiiakae* occurs on State and Federal lands.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Melicope hiiakae* is a small tree, 2 to 7 meters (m) (6.6 to 23 feet (ft)) tall, with new growth densely covered with whitish to pale brown waxy pubescence. Leaves are opposite, elliptic, glossy and medium green on the upper surface while the lower surface is paler green. Yellowish green male or female flowers are born on axillary cymes, are puberulent, and occur in clusters of 5 to 21. Capsules are dark green with 1 to 2 seeds per carpel (Stone *et al.* 1999a).

Taxonomy *Melicope hiiakae* was originally described by B. Stone as a species of *Pelea*. Hartley and Stone (1989) later submerged *Pelea* into *Melicope* and placed *M. hiiakae* in synonymy with *M. wawaeana*. In the supplement to the *Manual of the Flowering Plants of Hawaii*, Wagner and Herbst resurrected *M. hiiakae* from synonymy and recognized it as a distinct species (Joel Lau, Hawaii Natural Heritage Program, pers. comm. 1996 and 1999; Wagner and Herbst 2003), the most recently accepted Hawaiian plant taxonomy.

Habitat Mesic to wet forest and shrubland (Joel Lau, pers. comm. 1996, 1999; Stone *et al.* 1999).

Historical and Current Range/Current Status The current and historic range of this species is the

island of Oahu. Currently, *Melicope hiiakae* is known from four or five populations totaling about 20 individuals in the Koolau mountains, although there may be more individuals in areas that are difficult to survey due to steep terrain (Joel Lau, pers. comm. 1996, 1999; Kapua Kawelo, U.S. Army, pers. comm. 2005). While we do not know of any surveys or long-term trends since this information was provided, it is reasonable to assume the populations have continued to decline, since not all of the threats are being managed throughout all of its range.

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

This species is highly and imminently threatened by feral pigs (*Sus scrofa*) that degrade and destroy habitat (J. Lau, pers. comm. 1996). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitat on Oahu. Pigs are currently present on Oahu and four other islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Cuddihy and Stone 1990; Medeiros *et al.* 1986; Scott *et al.* 1986; Tomich 1986; Wagner *et al.* 1999a). No known conservation measures have been taken to date to address this threat.

B. Overutilization for commercial, recreational, scientific, or educational purposes.

None known.

C. Disease or predation.

Disease is not known to be a significant threat to this species. However, a tiny beetle, the black twig borer (*Xylosandrus compactus*) is known to infest a wide variety of common plant taxa, including *Melicope* in the Koolau mountains on Oahu (Davis 1970). The black twig borer burrows into branches, introduces a pathogenic fungus as food for its larvae, and lays its eggs. Twigs, branches, and even entire plants can be killed from an infestation. In the Hawaiian Islands, the black twig borer has many hosts, disperses easily, and is probably present at most elevations up to 762 m (2,500 ft) (Howarth 1985). The black twig borer occurs throughout the Koolau mountains and may pose a threat to all *Melicope hiiakae* plants that occur there. Currently, there is no effectively known control method for this threat.

Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980, Lamoureux 1994). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope *et al.* 1991). Therefore, even though we have no evidence of browsing for this species, it is likely that pigs impact this species directly as well as their indirect impacts to the surrounding habitat. No known conservation measures have been taken to date to address this threat.

D. The inadequacy of existing regulatory mechanisms.

Pigs are managed as a game animal in Hawaii. Pig hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources n.d.-a, n.d.-b, n.d.-c). However, public hunting does not adequately control the number of ungulates to eliminate this threat to native plant species. No other known conservation measures have been taken to date to address this threat.

E. Other natural or manmade factors affecting its continued existence.

Melicope hiiakae is threatened by alien plant species that degrade and destroy habitat (J. Lau, pers. comm. 1996).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al.* 1999a). Several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al.* 1998) indicate nonnative plant species may outcompete native plants similar to *Melicope hiiakae*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al.* 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al.* 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to habitat of *Melicope hiiakae*, the Service believes nonnative plant species are a threat to *Melicope hiiakae*. The remaining unmanaged populations of *Melicope hiiakae* are still impacted by this threat.

In addition, species like *Melicope hiiakae* that are endemic to single small islands are inherently more vulnerable to extinction from stochastic events than widespread species because of the higher risks posed to a few populations and individuals by genetic bottlenecks, random demographic fluctuations and localized catastrophes such as hurricanes.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

None known.

SUMMARY OF THREATS:

The major threats to this species include feral pigs that directly prey upon it, and degrade and destroy habitat, nonnative plants that compete for light and nutrients, the black twig borer, and stochastic events, which are believed to be a major cause of the decline of this species throughout its range. No conservation efforts have been initiated to date.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2*
	Non-imminent	Subspecies/population	3
		Monotypic genus	4
		Species	5
Moderate to Low	Imminent	Subspecies/population	6
		Monotypic genus	7
		Species	8
	Non-imminent	Subspecies/population	9
		Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

This species is highly threatened by feral pigs that directly prey upon it and degrade and destroy habitat, nonnative plants that compete for light and nutrients, the black twig borer, and stochastic events. Threats to the wet forest and shrubland habitat of *Melicope hiiakae* occur throughout its range and are expected to continue or increase without control or eradication. The low numbers of individuals and limited range also increase the risk of extinction risk to this species from the existing threats. No known conservation actions have been taken to date for these threats.

Imminence:

Threats to *Melicope hiiakae* from feral pigs, nonnative plants, black twig borer, and stochastic events are imminent because they are ongoing.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *Melicope hiiakae* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING:

Much of the information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995, and was updated by personal communication with Joel Lau, Hawaii Natural Heritage Program in 1996 and 1999. We have incorporated additional information on this species from our files and the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (2003). In 2004, the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new status or range information has been provided in 2004. In 2005 we contacted the species experts listed below and confirmation of the status of *Melicope hiiakae* was provided by Kapua Kawelo, U.S. Army.

The Hawaii Natural Heritage Program identified this species as critically imperiled (Hawaii Natural Heritage Program Database 2004). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Vulnerable (likely to become endangered in the near future) by Wagner *et al.* (1999b).

A species expert has provided new information confirming the status of the species this year and the results are included in this assessment.

COORDINATION WITH STATES:

In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, pers. comm. 2005).

LITERATURE CITED

List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Jim Jacobi	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer	June 28, 2005	Maui Land and Pineapple Company
6. Kapua Kawelo*	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	March 29, 2005	National Tropical Botanical Garden
9. Ken Wood	August 2, 2005	National Tropical Botanical Garden
10. Marie Bruegmann	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife

*Provided new information on this taxon in 2005

List all databases searched:

Name	Date
1. Hawaii Natural Heritage Program	2004

Other resources utilized:

- Carlquist, S. 1980. Hawaii: A natural history, 2nd edition. Pacific Tropical Botanical Garden, Honolulu. 468 pp.
- Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.
- Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Coop. Natl. Park Resources Stud. Unit, Hawaii. 138 pp.
- Davis, C.J. 1970. Black twig borer threatens native trees. Newsl. Hawaiian Bot. Soc. 9:38-39.
- Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawai'i. Cooperative National Park Resources Studies Unit, University of Hawaii. Technical Report 95.
- Hartley, T. and B. Stone. 1989. Reduction of Pelea with new combinations in Melicope (Rutaceae). Taxon 38: 119-123.
- Hawaii, Department of Land and Natural Resources. N.d.-a. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Oahu. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Howarth, F.G. 1985. Impacts of alien land arthropods and mollusks on native plants and animals in Hawai'i: in Stone, C.P. and J.M. Scott (eds.), Hawai'i's terrestrial ecosystems: preservation and management. Coop. Natl. Park Resources Stud. Unit, Hawaii, Honolulu, pp. 149-179.
- Lamoureux, C.H. 1994. Conserving Hawaiian biodiversity – the role of Hawaiian botanical gardens. Pp. 55-57. In: C.-I Peng and C.H. Chou (eds.). Biodiversity and Terrestrial Ecosystems. Institute of Botany, Academia Sinica Monograph Series No. 14.
- Loope, L.L., A.C. Medeiros, and B.H. Gagné. 1991. Recovery of Vegetation of a montane bog following protection from feral pig rooting. Coop. Natl. Park Resources Studies Unit, Univ. Hawaii/Manoa, Dept. Of Botany, Tech. Rept. 77.
- Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.
- Loope, L., F. Starr and K. Starr. 2004. Management and research for protecting endangered

- Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. *Weed Technology* 18: 1472-1474.
- Medeiros, A.C., L.L. Loope, P. Conant and S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian Islands. *Bishop Mus. Occas. Pap.* 48: 23-36.
- Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. *American Fern Journal* 82: 27-33.
- Medeiros, A.C., Jr., L.L. Loope, and R.A. Holt. 1986. Status of native flowering plant species on the south slope of Haleakala, East Maui, Hawaii. *Coop. Natl. Park Resources Stud. Unit, Hawaii, Techn. Rept.* 59:1-230.
- Robichaux, R., J. Canfield, F. R. Warshauer, L. Perry, M. Bruegmann, and G. Carr. 1998. Adaptive Radiation. *Endangered Species Bulletin*. November/December.
- Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: Their dynamics, ecology, and conservation. *Studies in Avian Biology* 9: 1-429. Cooper Ornithological Society, Los Angeles.
- Smathers, G.A. and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawai'i. *Proceeding of the Second Conference on Natural Science, Hawaii Volcanoes National Park*, pp. 274-288.
- Smith, C.W. 1985. Impact of alien plants on Hawai'i's native biota: *in* Stone, C.P., and J.M. Scott (eds.), *Hawai'i's terrestrial ecosystems: preservation and management*. *Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu*, pp. 180-250.
- Stone, B.C., W.L. Wagner, and D.R. Herbst. 1999. Rutaceae: *in* Wagner, W.L., D.R. Herbst, and S.H. Sohmer, *Manual of the flowering plants of Hawaii*. Univ. of Hawaii Press and Bishop Museum Press; Honolulu. *Bishop Mus. Spec. Pub.* 83:1174-1216.
- Stone, C.P. 1985. Alien animals in Hawai'i's native ecosystems: toward controlling the adverse effects of introduced vertebrates: *in* Stone, C.P., and J.M. Scott (eds.), *Hawai'i's terrestrial ecosystems: preservation and management*. *Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu*, pp. 251-297.
- Tomich, P.Q. 1986. Mammals in Hawai'i; a synopsis and notational bibliography. *Bishop Museum Press, Honolulu*. 375 pp.
- Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejnaneck, and R. Westerbrooks. 1997. Introduced species: a significant component of human-caused global change. *New Zealand Journal of Ecology* 21(1): 1-16.
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- Wagner, W.L., M.M. Bruegmann, and J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. *Bishop Mus. Occas. Pap.* 60: 1-58.
- Wagner, W.L. and D.R. Herbst. 2003. Electronic supplement to the manual of flowering plants of Hawai'i, version 3.1. December 12, 2003. Available from the Internet. URL: <http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm>.
- Wenkam, R. 1969. *Kauai and the park country of Hawaii*. Sierra Club, San Francisco. 160 pp.
- Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. Submitted by National Tropical Botanical Garden, October, 1997.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: **Acting** David W. Winkler 11/10/05
Regional Director, Fish and Wildlife Service Date

Marshall P. Jones

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____
Director, Fish and Wildlife Service Date

Date of annual review: September 20, 2005
Conducted by: Marie M. Brueggmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell Date: September 23, 2005
Plant Conservation Program Leader

Gina Shultz Date: October 13, 2005
Assistant Field Supervisor,
Endangered Species

Patrick Leonard Date: October 13, 2005
Field Supervisor